



FINAL

30 March 2007

Remedial Action Report

Operable Units A, B Terrestrial, D, and Naval Supply Center

Bremerton Naval Complex

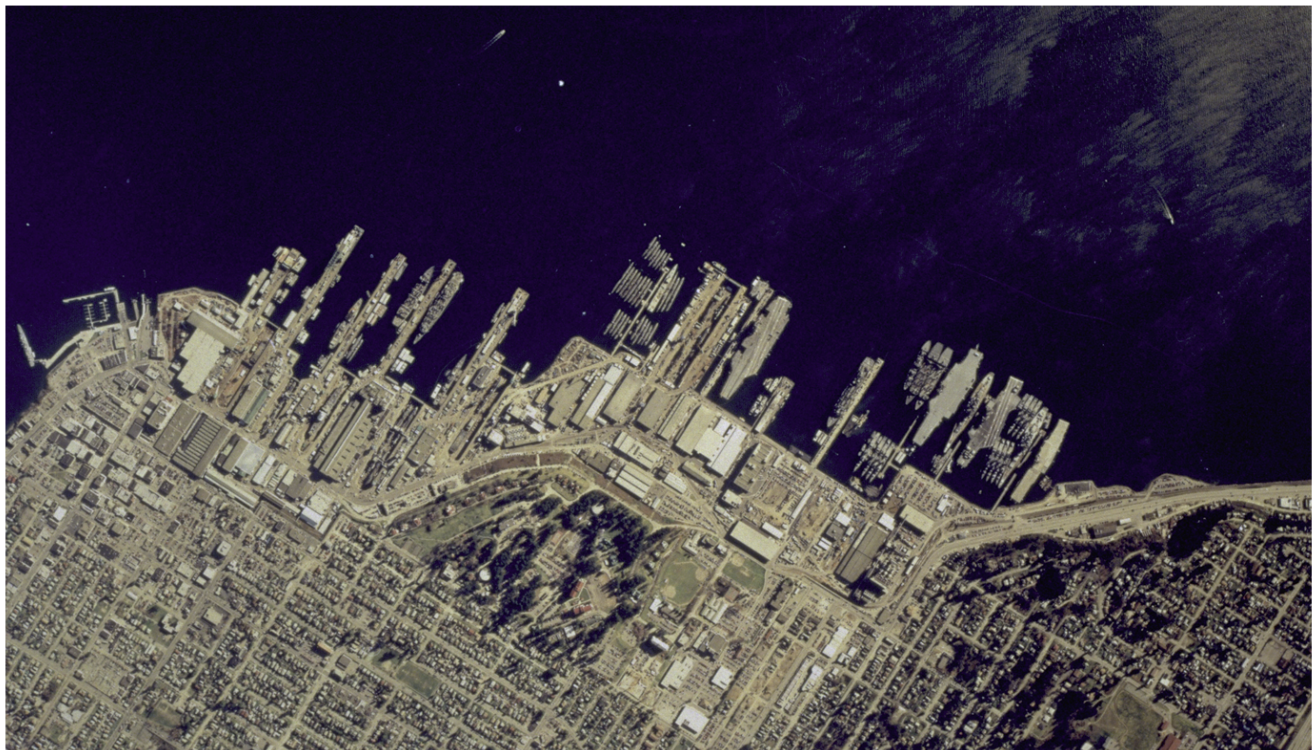
Bremerton, Washington

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RAC 3/TASK ORDER 52

REMEDIAL ACTION REPORT

OPERABLE UNITS A, B TERRESTRIAL, D,
AND NAVAL SUPPLY CENTER

BREMERTON NAVAL COMPLEX
BREMERTON, WASHINGTON

MARCH 30, 2007

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ACRONYMS AND ABBREVIATIONS

BNC	Bremerton naval complex
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DRMO	Defense Reutilization Marketing Office
EMAC	Environmental Multiple Award Contract
FISC	Fleet and Industrial Supply Center
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
FWENC	Foster Wheeler Environmental Corporation
IC	institutional control
IR	installation restoration
Navy	U.S. Navy
NBK	Naval Base Kitsap
NPL	National Priorities List
O & M	operation and maintenance
OU	Operable Unit
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PSNS & IMF	Puget Sound Naval Shipyard and Intermediate Maintenance Facility
RAC II	Remedial Action Contract N44255-95-D-6030
RAC 3	Remedial Action Contract N44255-01-D-2000
ROD	Record of Decision
SES-TECH	Sealaska Environmental Services-Tetra Tech EC, Inc.
SVOC	semivolatile organic compound
TtEC	Tetra Tech EC, Incorporated
TtFW	Tetra Tech FW, Incorporated
TPH	total petroleum hydrocarbons
VOC	volatile organic compound

1. INTRODUCTION

The Bremerton naval complex (BNC) is located in the City of Bremerton, in Kitsap County, Washington (Figure 1). The BNC includes the Puget Sound Naval Shipyard and Intermediate Maintenance (PSNS & IMF) and Naval Base Kitsap (NBK) at Bremerton. The Navy maintains 1,350 acres of property along the shoreline of Sinclair Inlet, an arm of Puget Sound. The primary role of NBK at Bremerton is to serve as a deep draft home-port for aircraft carriers and supply ships. The primary role of PSNS & IMF is to provide overhaul, maintenance, conversion, refueling, de-fueling, and repair services to the Naval fleet.

Industrial activities at the BNC since it was established have produced waste and environmental contaminants. These waste streams have included metal plating wastes, filings and shavings associated with metal work, petroleum products, transformers containing polychlorinated biphenyls (PCBs), electrical components, batteries, acids, oxidizing materials, paints and paint chips, degreasing and cleaning solvents, and wood and miscellaneous materials from shipbuilding and ship dismantling. Waste disposal practices that were consistent with industry standards and widely accepted at the time, particularly the use of miscellaneous waste material as fill during expansion of the BNC, together with historic spills and leaks of industrial materials have led to elevated levels of various chemicals in BNC soil and groundwater.

The BNC was proposed for inclusion on the National Priorities List (NPL) on May 10, 1993. The facility was assigned the Comprehensive Environmental Response, Compensation, and Liability Information System number WA2170023418 and formally added to the NPL on May 31, 1994. The BNC was originally divided into four operable units, OU A, OU B, OU C and OU Naval Supply Center (NSC). In 1999, OU B was divided into OU B Marine and OU B Terrestrial (OU B T) to allow the marine cleanup to be accelerated and executed in conjunction with navigational dredging and pier replacement activities also planned at the BNC. OU D, an area which was originally included in OU B T, was created in August 2002 to support the transfer of a parcel of property at the east end of the BNC to the City of Bremerton for development of a park. The limits of each OU are shown in Figure 2. The focus of this report is the remedial construction activities conducted to comply with the Record of Decision (ROD) requirements for BNC terrestrial OUs A, B T, D, and NSC. As of November 17, 2006, these requirements had been fulfilled, and the long-term monitoring and maintenance program is currently in effect.

Figure 1. Bremerton Naval Complex Vicinity Map

Figure 2. Bremerton Naval Complex Operable Units

2. OPERABLE UNIT BACKGROUND

2.1 OU A

OU A is situated at the southwestern end of the BNC, along Sinclair Inlet. It encompasses an area of approximately 12 acres created by the placement of fill material. The initial fill at OU A was placed in the 1940s. The site was brought to its present configuration by the placement of additional fill in 1956 and 1971. Between 1963 and 1972, liquid wastes were disposed of in unlined pits in the general area. Copper slag and sandblast materials reportedly were deposited at the site beginning in the mid-1950s. Other potential contaminant sources include dredge spoils, burn pits, and helicopter fueling operations. The site now comprises parking areas for visitors, Naval personnel, and shipyard workers. Contaminants of concern identified in the ROD for OU A include heavy metals, semivolatile organic compounds (SVOCs), pesticides/PCBs, volatile organic compounds (VOCs), and total petroleum hydrocarbons (TPH).

The selected remedy for OU A included the following components:

- Upgrade the pavement cap over approximately 3.7 acres
- Place erosion protection (additional riprap or stabilized cobble/gravel layer) along approximately 1,400 linear feet of the existing shoreline
- Implement institutional controls consisting of fencing, warning signs, extended prohibition on fish and shellfish harvesting at Charleston Beach, and land use restrictions on residential use
- Implement marine and terrestrial habitat enhancements
- Groundwater monitoring
- Create a monitoring program that examines and reports on all elements of the remediation
- Conduct regular inspection and maintenance of the pavement cap and erosion protection, particularly after storms
- Periodic reviews

The OU A ROD established the following remedial action objectives (RAOs):

- Prevent human contact with soil containing lead, arsenic, PCBs, and polycyclic aromatic hydrocarbons (PAHs) above acceptable levels

- Reduce the physical hazards associated with the existing riprap, such as scrap metal, construction debris, and fill materials
- Limit erosion of heavy metal and organic constituents in fill materials to Sinclair Inlet marine waters through the existing riprap
- Reduce the transport of chemicals to groundwater or the marine environment
- Enhance terrestrial and marine habitat

2.2 OU B T

OU B T encompasses most of the industrial property along the BNC shoreline. Much of OU B T was created by the placement of soil and industrial fill, beginning in 1905. Fill operations resulting in the current land configuration were completed in 1975. Because a large number of chemicals were detected within OU B T, key representative contaminants of interest (arsenic, copper, lead, mercury, zinc, PAHs, and PCBs) were selected to simplify and focus discussion of chemical distribution and fate and transport. Chemicals of potential concern identified in the human health risk assessment included arsenic, PAHs, and PCBs.

The selected remedy for OU B T included the following components:

- Stormwater facility restoration—includes sediment and debris removal, inspection of the integrity of the stormwater lines and catch basins, and repair or replacement of damaged storm drain lines and catch basins where required and feasible
- Installing pavement or clean soil cover with vegetation in unpaved areas and repairing existing damaged pavement to limit potential infiltration of water into site soil
- Shoreline stabilization—repair of portions of existing shoreline protection with potential for erosion
- Institutional controls—development and implementation of excavation management and land use control plans and groundwater use restrictions
- Groundwater monitoring—installation and monitoring of compliance wells

The OU B T ROD established the following RAOs:

- Continue to limit human exposure to site soils and groundwater
- Reduce the potential for chemical transport and control the threat of recontamination of the adjacent marine environment from:
 - Accumulation of sediment or debris in the stormwater system

- Infiltration of soil and groundwater into the stormwater system
- Infiltration of surface water into the site soil
- Erosion of shoreline soil

2.3 OU D

OU D is situated along the eastern border of the BNC, directly west of the Washington State ferry terminal. The area adjacent to the waterfront where OU D is located is suspected to have been used as a disposal site. This area was subsequently filled with miscellaneous material, including sandblast grit, to create land to accommodate Naval operations, which consisted primarily of administrative support functions and a metal storage area.

OU B T, which originally included the area now designated OU D, was evaluated under an industrial land use scenario, and further investigation was required to address the potential change to recreational land use. OU D was developed to define the area of additional investigation and consisted of 5.3 acres; however, the extent of the potential transfer was not defined. Subsequent to the investigation, the Navy defined the area available for transfer, and the boundary of OU D was reduced to the area of land available for recreational land use. OU D as revised includes the easternmost 2.5 acres of the BNC. The shoreline along the south and east edges of OU D remains in OU B T. Contaminants of concern identified in the ROD for OU D include heavy metals, SVOCs, pesticides/Aroclors, VOCs, and TPH.

The selected remedy for OU D included the following components:

- Install asphalt pavement or soil cover with vegetation over the uncapped areas of OU D
- Cleaning and inspection of the stormwater system at OU D, including the repair or replacement (as necessary) of significant structural damage (i.e., collapse or break) in the drain pipes, manholes, and catch basins
- Implement institutional controls consisting of land use restrictions, groundwater use restrictions, and maintenance of asphalt pavement and vegetative cover
- Groundwater monitoring

The OU D ROD established the following RAOs:

- Continue to limit human exposure to site soils and groundwater

- Reduce the potential for chemical transport to the adjacent marine environment from:
 - Accumulation of sediment or debris in the stormwater system
 - Infiltration of soil and groundwater into the stormwater system
 - Infiltration of surface water into the site soil

2.4 OU NSC

OU NSC is situated along Sinclair Inlet in the western half of the BNC, between the Controlled Industrial Area and the Industrial Support Area. Initially a tideland, the land at OU NSC was created by the placement of fill material as the complex expanded between approximately 1900 and 1950. Some of the material was excavated from the natural hillside upgradient of OU NSC. The remainder is believed to have consisted of miscellaneous solid waste from Shipyard operations, including excavated soils and sediments, construction debris, and spent sandblast grit. The area represented by OU NSC was used to support the storage and supply of materials and equipment for the BNC. The Defense Reutilization Marketing Office (DRMO) also operated a metal scrap yard on approximately 3 acres of land within the boundaries of the OU. Contaminants of concern identified in the ROD for OU NSC include heavy metals, SVOCs, pesticides/PCBs, and TPH.

The selected remedy for OU NSC included the following components:

- Placing asphalt concrete pavement on currently unpaved areas and repairing and replacing existing asphalt concrete not in good condition, including regular inspection and maintenance
- Cleaning and inspection of the stormwater system, including critical repairs
- Institutional controls and monitoring consisting of access control, groundwater and land use restrictions, best management practices, excavation management plan, and storm drain maintenance plan

The OU NSC ROD established the following RAOs:

- Reduce the potential for arsenic, copper, nickel, lead, pesticides, PCBs, and TPH to reach the groundwater, to the extent feasible, using technologies that are implementable and effective for the site
- Reduce the human exposure to the chemicals of concern and to reduce or control contamination of the groundwater

- Reduce the potential for chemicals of concern to be introduced into water flowing through the storm drains and thus discharged to Sinclair Inlet.
- Reduce the potential for chemicals of concern in the storm drain sediments to be discharged to Sinclair Inlet.

3. CONSTRUCTION ACTIVITIES

The remedial construction activities for each OU are summarized below. Electronic copies of all Remedial Action/Closure Reports referenced in this section are included on compact disc in Appendix A. The work areas discussed in this section are shown in Figures 3 through 5.

3.1 OU A

Two remedial construction projects were executed to implement the OU A remedy—*Remedial Design/Remedial Action, Operable Unit A* (Delivery Order [DO] 6) and later, *Repairs at Operable Unit A* (DO 75), both awarded under Remedial Action Contract N44255-95-D-6030 (RAC II). The initial remedial scope of work, which are described in detail in the *Final Remedial Action Report, Remedial Design/Remedial Action, Operable Unit A* (Foster Wheeler Environmental Corporation [FWENC] 1999a), included:

- Constructed approximately 1,200 linear feet of engineered shoreline protection incorporating marine habitat enhancements
- Constructed approximately 1,200 linear feet of planting medium structure with vegetation along the top of the shoreline protection system as terrestrial habitat enhancements
- Installed 16 nest boxes for Purple Martins
- Improved site stormwater control and rehabilitated pavement in localized areas
- Seal coated the entire Missouri Parking Lot and installed two monitoring well vaults/covers

Subsequent to completion of the initial remedial scope of work, deterioration of a localized section of seawall situated just beyond the east limit of the original work area was identified. As a result, the additional remedial activities listed below and described in detail in the *Addendum to Final Remedial Action Report, Repairs at Operable Unit A* (FWENC 2000a) were performed.

- Replaced approximately 100 linear feet of deteriorating concrete debris seawall with a steel sheet pile retaining wall
- Constructed an upland vegetated corridor along the new retaining wall
- Placed fine-grain fish rock habitat mix along the base of the new retaining wall
- Restored and seal coated the asphalt pavement within the project area

3.2 O U B T

Nine removal or remedial actions were executed to implement the O U B T remedy. These actions and their corresponding scopes of work are identified below:

Paving Operable Unit B Sites (RAC II DO 37)

- Constructed asphalt pavement and/or vegetated caps over nine unpaved areas under a Non-Time Critical Removal Action. Although originally planned under this remedial action, a portion of one area near Mooring A, which was used for the storage of low-level radioactive wastewater was not paved. This area is being addressed and managed by the Radiological Affairs Support Office (Figure 5).
- Installed storm water collection systems at selected locations, as needed

The above activities are documented in two reports: 1) *Closure Report, Site 1-C2, Operable Unit B* (FWENC 1998) and *Remedial Action Report, Paving Sites, Operable Unit B* (FWENC 2000b).

Treatability Study, Operable Unit B (RAC II DO 104)

- Cleaned and inspected the storm drains within a 50-acre area to support the design of the storm drain component of the remedy

The above efforts are documented in the *Final Closure Report, Treatability Study, Operable Unit B* (FWENC 2002).

Operable Unit B Paving Upgrades (Environmental Multiple Award Contract [EMAC] N68711-02-D-8306 Task Order [TO] 3)

- Constructed asphalt pavement caps over 57 previously unpaved areas (approximately 2.6 acres)

These activities are documented in the *Final Closure Report, Bremerton Naval Complex, Operable Unit B Paving Upgrades* (GeoEngineers, Inc. 2004).

OU B Uplands Remedial Action, Phases 1 and 2 (Storm Drain Cleaning, Inspection, and Repair) (Remedial Action Contract N44255-01-D-2000 [RAC 3] TO 9)

- Cleaned and inspected the storm drain systems throughout OU B T and OU D
- Repaired/replaced 3,270 linear feet of storm drain pipe
- Repaired 18 catch basins and manholes; installed 8 new catch basins and manholes
- Asphalt-paved the area used by the project as a laydown area

The above activities are documented in the *Final Remedial Action Report, Storm Drain Cleaning, Inspection, and Repair, Operable Unit B Terrestrial* (Tetra Tech EC, Inc. [TtEC] 2006a).

Phase II Remedial Action, Shoreline Protection (RAC 3 TO 17)

- Conducted a comprehensive inspection and evaluation of the BNC seawall
- Removed 500 tons of debris along 2,920 linear feet of shoreline
- Constructed erosion control system and marine habitat enhancements (fish mix beaches and rat rock), along 2,920 linear feet of shoreline
- Constructed an upland planter section with native woody riparian vegetation along 1,000 linear feet of shoreline

The above shoreline measures are described in detail in the *Final Remedial Action Report, Erosion Control System, Operable Unit B Terrestrial* (TtEC 2006b).

East End Capping (RAC 3 TO 21)

- Constructed an asphalt pavement cap over 2 acres of unpaved area at the east end of the BNC
- Installed a stormwater collection system, which incorporates sediment capture technology (storm filter), to collect runoff from the pavement cap

These activities are documented in the *Final Removal Action Closure Report, Asphalt Pavement Cap, East End Capping – Operable Unit D* (Tetra Tech FW, Inc. [TtFW] 2005).

Vegetated Cap Design and Construction, Operable Unit D (RAC 3 TO 36)

- In conjunction with construction of a vegetated cap at OU D, capped one-third acre of the sloped area adjoining OU B T west of the new BNC perimeter fence

- line with a low-permeability soil layer and covered the soil layer with 10-mil high-density polyethylene liner and crushed rock
- Installed a stormwater collection system and paved a 7,600-square foot area to complete the asphalt pavement cap initiated under TO 21

Details of the above activities are provided in the *Final Remedial Action Report, Vegetated Cap Construction, Operable Unit D* (TtEC 2007).

Repair R Street Storm Drain (RAC 3 TO 40)

- Installed 750 linear feet of new storm drain system to replace an existing primary system that was severely damaged

This effort is detailed in the *Project Summary, R Street Sanitary Sewer and Storm Drain Repairs* (TtFW 2004).

3.3 OU D

The remedy at OU D consisted of constructing a clean soil cap with vegetation over approximately 2.5 acres of land situated at the extreme east end of the BNC, outside the new perimeter fence line, to accommodate a property transfer agreement between the Navy and the City of Bremerton. The Navy will retain a 20-foot-wide easement along the west boundary of the cap. This action, which was conducted under RAC 3 TO 36, is described in detail in the *Final Remedial Action Report, Vegetated Cap Construction, Operable Unit D* (TtEC 2007).

3.4 OU NSC

The remedial activities for OU NSC, conducted under RAC II DO 27, are listed below and described in detail in the *Remedial Action Report, Remedial Actions at Operable Unit Naval Supply Center* (FWENC 1999b).

- Cleaned and inspected the storm drain systems throughout the OU
- Repaired/replaced 1,500 linear feet of damaged storm drain pipe and numerous catch basins/manholes
- Sealed storm drains found to no longer to be in service
- Installed new storm drains throughout the former DRMO yard and Fleet and Industrial Supply Center (FISC) parking lot

- Paved approximately 3.5 acres, including previously unpaved areas, replacement of damaged pavement, and complete repaving of the former DRMO yard and FISC parking lot

Figure 3. Storm Drain Remedial Action Boundaries

Figure 3 (continued)

Figure 4. Remedial Action Work Areas – Pavement/Vegetated Caps and Shoreline Protection (West)

Figure 4. (continued)

Figure 5. Remedial Action Work Areas – Pavement/Vegetated Caps and Shoreline Protection (East)

Figure 5. (continued)

4. CHRONOLOGY

Provided below are the sequences of events for the remedial actions at OU A, OU B T, OU D, and OU NSC.

OU A

January 29, 1997	ROD signed
December 19, 1997	Submit Work Plan (RAC II DO 6)
January 26, 1998 – March 4, 1998	Install shoreline protection system (RAC II DO 6)
March 9, 1998 – April 28, 1998	Construct upland planter section (RAC II DO 6)
July 11, 1998 – August 1, 1998	Restore and seal asphalt pavement (RAC II DO 6)
August 3, 1999	Submit Remedial Action Report (RAC II DO 6)
June 6, 2000	Submit Supplemental Work Plan (RAC II DO 75)
July 20, 2000 – August 24, 2000	Remove existing concrete seawall/install steel sheet pile wall (RAC II DO 75)
September 25, 2000 – October 18, 2000	Construct extension of upland planter section (RAC II DO 75)
October 19, 2000 – October 23, 2000	Restore and seal asphalt pavement (RAC II DO 75)
December 8, 2000	Submit Addendum to Remedial Action Report (RAC II DO 75)

OU B T

January 23, 1998	Submit Work Plan to pave various areas throughout the BNC (RAC II DO 37)
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March 31, 1998	Action Memorandum signed selecting capping (asphalt or concrete paving) as an interim measure pending the ROD
April 8, 1998	Submit Work Plan addenda (RAC II DO 37)
April 13, 1998 – September 9, 1998	Construct pavement cap at one location in central BNC (RAC II DO 37)
September 1999	Action Memorandum modified to include soil/vegetated cap option
January 1998 – May 2000	Construct pavement/vegetated caps at eight additional locations throughout the BNC (RAC II DO 37)
October 23, 1998	Submit Closure Report for pavement cap at one location in central BNC (RAC II DO 37)
June 15, 2000	Submit Remedial Action Report for pavement/vegetated caps at eight additional locations throughout the BNC (RAC II DO 37)
October 19, 2001	Submit storm drain treatability study Work Plan (RAC II DO 104)
March 13, 2002 – August 29, 2002	Conduct treatability study to support storm drain remedial design (RAC II DO 104)
November 5, 2002	Submit Closure Report for storm drain treatability study (RAC II DO 104)
February 13, 2003	Submit Work Plan for construction of an asphalt caps over unpaved areas of the steel storage yard at east end of the BNC (RAC 3 TO 21)
March 7, 2003	Submit Work Plan – Storm Drain Cleaning, Inspection, and Repair (RAC 3 TO 9)
April 1, 2003	Submit Work Plan for pavement upgrades in 57 additional areas (EMAC TO 3)

June 13, 2003 – December 4, 2003	Construct pavement upgrades in 57 additional areas (EMAC TO 3)
June 26, 2003	Action Memorandum implementing anticipated storm drain remedy issued pending ROD
July 8, 2003	Begin cleaning storm drain systems (RAC 3 TO 9)
August 6, 2003 – December 19, 2003	Construct first phase of asphalt pavement cap in steel storage yard (RAC 3 TO 21)
August 11, 2003	Begin inspecting storm drain systems (RAC 3 TO 9)
August 29, 2003	Submit Work Plan – Erosion Control System addressing shoreline protection enhancements along 2,750 linear feet of seawall (RAC 3 TO 17)
September 17, 2003	Action Memorandum for implementation of shoreline protection remedy signed
October 2, 2003 – March 11, 2004	Construct shoreline erosion control system and vegetated planters along 2,750 linear feet of seawall (RAC 3 TO 17)
March 8, 2004	ROD signed
April 8, 2004	Submit Closure Report for 57 areas paved under EMAC TO 3
April 26, 2004 – March 7, 2006	Implement storm drain repairs (RAC 3 TO 9)
June 2, 2004	Submit Work Plan – R Street Sanitary Sewer and Storm Drain Repairs (RAC 3 TO 31/40)
June 1, 2004 – September 21, 2004	Construct the second phase of asphalt pavement cap in the steel storage area (RAC 3 TO 21)
June 7, 2004 – September 30, 2004	Repair R Street storm drains (RAC 3 TO 40)

November 17, 2004	Submit Project Summary – R Street Sanitary Sewer and Storm Drain Repairs (RAC 3 TO 40)
January 10, 2005	Submit Removal Action Closure Report documenting the first two phases of pavement cap construction in the steel storage yard (RAC 3 TO 21)
May 11, 2005	Submit Work Plan addressing final pavement cap section in the steel storage area (RAC 3 TO 36)
May 20, 2005	Submit Work Plan Supplement – Erosion Control System to address shoreline protection enhancements along an additional 70 linear feet of seawall at the east end of the BNC (RAC 3 TO 17)
September 12 – 19, 2005	Construct shoreline erosion control system along an additional 170 linear feet of seawall (RAC 3 TO 17)
February 28, 2006	Submit OU B T Institutional Controls and Operation and Maintenance Plans (RAC 3 TO 18)
April 4, 2006	Submit Remedial Action Report – Erosion Control System (RAC 3 TO 17)
June 15, 2006 – July 20, 2006	Construct pavement cap at remaining section of Area D1 (north section) (RAC 3 TO 36)
September 29, 2006	Submit Remedial Action Report – Storm Drain Cleaning, Inspection, and Repair (RAC 3 TO 9)
March 30, 2007	Submit Remedial Action Report documenting construction of final pavement cap section (north) in Area D1 (RAC 3 TO 36)

OU D

OU D remedial actions were executed under RAC 3 TO 36.

May 11, 2005	ROD signed
May 11, 2005	Submit Work Plan – Vegetated Cap Construction
June 1, 2005 – November 17, 2006	Construct vegetated cap
March 30, 2007	Submit Remedial Action Report – Vegetated Cap Construction

OU NSC

OU NSC remedial actions were executed under RAC II DO 27.

December 13, 1996	ROD signed
May 23, 1997	Submit Work Plan
June 2, 1997 – August 1997	Phase 1 fieldwork (clean/inspect storm drains; pave uncapped areas)
November 11, 1997	Submit Work Plan addendum (Phase 2)
November 17, 1997 – February 24, 1998	Phase 2 fieldwork (repair storm drains outside DRMO yard/FISC parking lot; pave uncapped areas; pavement repairs)
June 12, 1998	Submit Work Plan addendum (Phase 3)
July 6, 1998 – March 26, 1999	Phase 3 fieldwork (install/repair storm drains inside DRMO yard; grade/repave entire area)
April 16, 1999	Submit Remedial Action Closeout Report

5. PERFORMANCE STANDARDS AND CONSTRUCTION QUALITY CONTROL

The RAOs for OUs A, B T, D, and NSC are based on the need to prevent or limit human exposure to contaminants of concern and to contain contaminated terrestrial media (i.e., soil, groundwater, and stormwater system sediment and debris) and limit transport to the adjacent marine environment. The remedial measures described in Section 3 of this

report, and documented in detail in Appendix A, have met these objectives. Long-term monitoring and maintenance will ensure that the remedies continue to function as intended.

The remedial action plans and accompanying quality control requirements that were implemented were reviewed and approved by the applicable regulators and stakeholders. The plans addressed the inspections and testing that would be performed to ensure conformance to the approved designs. The remedial actions were conducted in accordance with the approved plans. Results of the quality control measures are documented in the individual reports for each site (Appendix A).

6. INSTITUTIONAL CONTROLS

The following institutional controls (IC) have been implemented at OU A, OU B T, D, and OU NSC, as outlined in the respective RODs.

- Access controls (signage and security)
- Groundwater use restriction
- Land use restrictions
- Excavation management

The objectives of these ICs are to ensure that:

- access to the BNC is controlled;
- the sole use of groundwater is for monitoring purposes;
- the established industrial use of the site is maintained; and
- excavations are managed appropriately given the contaminants left in place.

The documents listed in Table 1 (or the most current versions) govern implementation of the ICs, as shown. The detailed IC Work Plan (TtEC 2006c) is included electronically in Appendix B.

Table 1. Reference Documents and ICs

Requirements	Type of IC			
	Access Control	Groundwater Restrictions	Excavation Management	Land Use Restrictions
IC Work Plan	x	x	x	x
Navy Physical Security - OPNAVINST 5530.14C	x			
Physical Security, Access and Movement Control at Shore Activities - NAVSEAINST 5510.2B	x			
Puget Sound Naval Shipyard Physical Security - NAVSHIPYDPUGETINST 5530.1	x			
NAVSTAINST 5530.1	x			
Outages and Excavations - NAVSTABREMERTON INSTRUCTION 11310.10D		x	x	

Inspection and maintenance of the ICs, as discussed in Section 7 of this report, will ensure that the RAO of limiting human exposure to site soils and groundwater is maintained. As part of the OU D property transfer agreement between the Navy and the City of Bremerton, the City will bear the responsibility for ICs at that site. The deed restrictions will ensure that the ICs are transferred with the property. Groundwater monitoring at OU D has been maintained by the Navy in conjunction with the monitoring requirements for OU B T.

7. OPERATION AND MAINTENANCE

A comprehensive operation and maintenance (O & M) plan is in place to address periodic inspection of the remedies at OU A, OU B T, D, and OU NSC. The plan includes decision diagrams, which provide the basis for determining when maintenance or repairs are required to preserve the integrity of the remedies. As with institutional controls, the City of Bremerton will bear the responsibility for maintaining the remedy at OU D.

Table 2 provides the inspection and maintenance components associated with each OU. The detailed O & M Plan (TtEC 2006d) is included electronically in Appendix B.

Table 2. Inspection and Maintenance Matrix

Operable Unit	Institutional Controls	Excavation Management	Pavement/ Vegetative Cap	Shoreline	Storm Drains/ Catch Basins	Monitoring Wells
A	x	x	x	x		x
B T	x	x	x	x	x	x
D	x	x	x		x	x
NSC	x	x	x			x

8. LONG-TERM MONITORING

Due to saltwater intrusion, there is no current or anticipated future beneficial use of groundwater at the BNC. Analyses of primary fate and transport mechanisms determined that the site groundwater is sufficiently protective of the marine environment and that no active groundwater remediation is warranted. Nonetheless, a comprehensive long-term monitoring program has been implemented at OU A, OU B T, D, and OU NSC in accordance with the requirements of the respective RODs to monitor chemical concentrations that could suggest a change in the risks posed at the sites. Despite the transfer of OU D property to the City of Bremerton, the Navy is conducting groundwater monitoring at OU D in conjunction with the monitoring requirements for OU B T in accordance with the OU D ROD.

Table 3 provides an overview of the sampling frequency and required analyses. The monitoring program is discussed in detail in the *Final Long-Term Monitoring Plan for OU A, OU NSC, OU B T, PMP, and OU C, Revision 2* (Sealaska Environmental Services-Tetra Tech EC, Inc. [SES-TECH] 2006).

Table 3. Analytical Parameters

Location	Frequency	TSS 160.2	TCE 8260B	Pesticides 8081A Low Level	Dissolved Metals 6020	Total Mercury 7470	Total Metals 6020
OU A	Semi-Annual						x
OU B T	Annual		x	x	x	x	
OU D	Annual		x	x	x	x	
OU NSC	Semi-Annual	x					x

Notes: TSS = Total Suspended Solids

TCE = Trichloroethene by U.S Environmental Protection Agency (EPA) Method 8260B

Clarifications:

- OU A – Target analytes for total metals include arsenic, copper, lead, nickel, and zinc.
- OU B T & OU D – Target analytes for pesticides include 4,4'-DDE, 4,4'-DDT, aldrin, dieldrin, and heptachlor epoxide. Target analytes for total metals include mercury, while target analytes for dissolved metals include arsenic, copper, lead, nickel, and zinc. If free-petroleum-related product is present in a well, a product or product/water sample will be collected for analysis of total PCB

Aroclors by EPA Method 8082. If PCBs are not detected, PCB analysis will be discontinued.

- OU NSC – Target analytes for total metals include arsenic, copper, lead, and nickel.

9. SUMMARY OF PROJECT COSTS

Table 4 provides a comparison between the estimated remedy costs and actual costs of implementation. Total costs by project are included in Appendix C. Table 5 provides the estimated annual long-term monitoring/remedy maintenance costs for each OU.

Table 4. Remedial Action Costs

	ROD Estimate	Actual Cost
OU A	\$1.066M	\$2.032M
OU B T	\$11.940M	\$16.124M
OU D	\$1.333M ^{\1}	\$1.969M
OU NSC	\$2.628M	\$2.556M

- \1 Includes ~\$75K for construction of the final section of OU B T asphalt pavement cap at the east end of the BNC which fell within the originally established boundary for OU D

Table 5. Annual Long-Term Monitoring/Remedy Maintenance Cost

	ROD Estimate^{\1}	Actual Cost (2006)
OU A	\$67K	\$154K
OU B T	\$298K	\$168K
OU D	NA ^{\2}	NA
OU NSC	\$162K	\$153K

- \1 Estimated undiscounted annual cost

- \2 Groundwater monitoring costs for OU D are incorporated into the OU B T monitoring costs

10. CONTACT INFORMATION

The Navy Remedial Project Manager for the remedial action:

Dina Ginn
Naval Facilities Engineering Command Northwest
1101 Tautog Circle, Suite 203
Silverdale, Washington 98315-1101

The Navy used the following prime contractors for the remedial actions:

A. N. Bolt, Navy RAC Program Manager	John H. Biggane, Principal
Tetra Tech EC, Inc.	GeoEngineers, Inc.
1050 NE Hostmark Street, Suite 202	1101 S. Fawcett Avenue, Suite 200
Poulsbo, Washington 98370	Tacoma, Washington 98402

The Navy is using the following contractor to perform the long-term monitoring and inspection of the remedies:

Derik Fredericksen
Sealaska Environmental Services-Tetra Tech EC, Inc
13810 S.E. Eastgate Way, Suite 420
Bellevue, Washington 98005

The Project Manager for the EPA:

Nancy Harney
U.S. EPA
1200 Sixth Avenue
Seattle, Washington 98101

APPENDIX A

REPORTS

APPENDIX B

PLANS

APPENDIX C
REMEDIAL ACTION COSTS BY PROJECT

REMEDIAL ACTION COSTS BY PROJECT

Operable Unit	DO/TO	Description	Cost
A	RAC II DO 6	Remedial Design/Remedial Action - OU A	\$1,175,336
	RAC II DO 75	Repairs at OU A	\$857,028
B T	RAC II DO 37	Paving OU B Sites	\$1,843,724
	RAC II DO 104	Treatability Study - OU B	\$1,057,116
	EMAC TO 3	OU B Paving Upgrades	\$1,109,266
	RAC 3 TO 9	OU B Uplands Remedial Action - Phases 1 & 2	\$6,252,733
	RAC 3 TO 17	Erosion Control System - OU B Terrestrial	\$3,907,451
	RAC 3 TO 18	Land Use Controls/O & M Plan	\$165,813
	RAC 3 TO 21	East End Capping	\$1,248,018
	RAC 3 TO 40	Repair 'R' Street Sewer Piping (storm drains)	\$705,817
D	RAC 3 TO 36	Vegetated Cap Design & Construction, OU D	\$1,969,213 ^{\1}
NSC	RAC II DO 27	OU NSC Storm Drain Remedial Action - FISC	\$2,556,061
Total			\$22,847,576

\1 Includes ~\$75K for construction of the final section of OU B T asphalt pavement cap at the east end of the BNC which fell within the originally established boundary for OU D

APPENDIX D

REFERENCES

REFERENCES

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